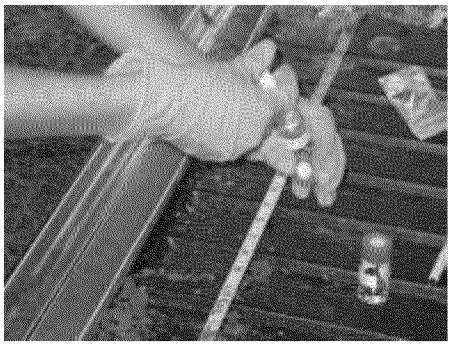

Figure 4-9. Collecting Soil Increments from a Split Spoon Sampler

Collection of soil increments to be tested for VOCs. (photos provided by A. D. Hewitt, C.A. Ramsey and S.R. Bigl)

Figure 4-10. Methanol Containers for Volatile Samples

Increments are placed in a container with an equal mass of methanol.

repeated with each increment. Sampling devices should be decontaminated or disposed of between decision units.

A minimum of a 1:1 ratio of sample preservative to sample soil (i.e., 1 milliliter of methanol to 1 gram of soil) is recommended. Additional preservative may be required to ensure the sample mass is completely submerged by the preservative. This should be discussed with the laboratory that will receive and analyze the samples. To select the appropriately sized sample container, consideration should be given to the total volume of soil to be collected and preservative required (e.g., 30 increments of 5 gram volume each would provide an approximately 150 gram volume and require approximately 150 milliliters of preservative). Utilize a container that is large enough to accommodate additional preservative (if needed) and to prevent loss of preservative through splashing (as soil increments are dropped into the container).

Similar types of devices can be used to collect *Multi-increment* samples from boring cores. As the zone targeted for the collection of *Multi-increment* samples is identified and increments collected at regular intervals (Figure 4.9), increments are placed directly into a container with a preservative (Figure 4.10). As shown in Figure 4.11, this approach provides a much better coverage of the core than a single discrete sample. The collection and analysis of a single *Multi-increment* sample also significantly reduces lab costs in comparison to multiple discrete samples. Another sub-sampling approach is to slice a wedge or portion of the core down the entire length of the vertical increment of interest.

Soil gas data are also highly recommended for characterization of sites contaminated with volatile chemicals, and may be more appropriate for some site investigations than soil sampling. Soil gas data are much more reliable than soil data for evaluating potential vapor intrusion hazards associated with volatile contaminants in soil (and groundwater). Soil gas data are also very useful for identifying and locating areas of heavy contamination. Refer to the HDOH guidance document Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater (HDOH, 2008a) and Section 7 of this guidance for additional information.

4.2.8 Collection of Multi-increment Samples for Stockpiles

Multi-increment sampling is the recommended method for characterizing soil stockpiles. Approaches similar to those described in Sections 4.2.1 through 4.2.7 should be used. If volatile

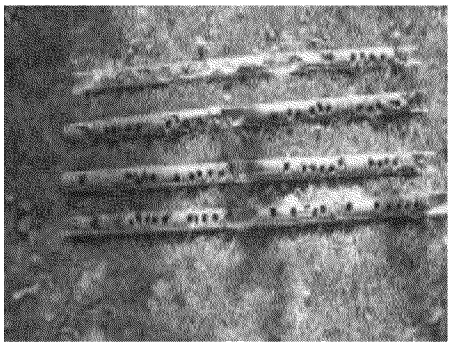

Figure 4-11. Soil Cores Multi-increment-Sampled

Core after collection of *Multi-increment* sample (photo provided by A. D. Hewitt, C. A. Ramsey and S. R. Bigl).

contaminants are being sampled, increments should be collected from depths greater than 6 to 12 inches below the surface of the pile.

Special considerations for selecting DUs for sampling soil stockpiles include:

- The source of the soil in the stockpile
- How the stockpile was created (over time, if applicable)
- How best to access the pile for sampling, especially if it is large and or unstable
- What contaminants should be targeted for lab analyses

To the extent that background information is available to address these or related issues, it should be obtained, examined and included in the SAP for the stockpile sampling.

One of the best options in certain cases is to coordinate sampling with the formation of any stockpiles on the site. When the stockpile is being formed there is generally good access to sampling each portion of the pile over time, and ensuring access to the entire stockpile DU is provided for good sample representativeness. If an existing stockpile is relatively small, good options may be to have the pile moved and take the MIS increments while it is being moved (e.g., from the front-end loader buckets, at appropriate intervals), or to flatten or spread out the stockpile sufficiently so that it is safely accessible to sample with a hand coring (or other) device.

If the stockpile is very large or unstable, all available sampling tools (see Section 5) or methods that safely provide access should be considered, with the goal of coming as close as possible to collecting a minimum of 30 systematic-random or stratified-random samples throughout the stockpile (both vertical and horizontal locations). Replicates are important to evaluate the precision of stockpile sampling, and should be collected similarly to the original sample except in separate random locations. Large stockpiles could be broken or segregated into separate DUs, especially if it is known that a specific portion or volume of the stockpile will be used in a manner that will become the primary exposure unit of concern in the future (e.g., certain portions or volumes of the stockpile will be hauled to residential lots as surface fill for backyards).

Where access and/or safety issues are significant concerns in collecting appropriate MIS for stockpiles, the HEER Office should be consulted on options for alternate sampling plans.

4.2.9 Multi-increment Sampling for Site Characterization Versus Site Remediation

The objectives of *Multi-increment* sampling for initial site characterization are typically distinct from *Multi-increment* sampling aimed at making decisions on subsequent site remediation (if applicable). After selection of DUs at the site, initial sampling focuses on obtaining the average concentration in each DU for comparison to the appropriate HDOH EAL. Then, only in those DUs where a potential exposure risk has been identified (i.e., an HDOH EAL exceedance) and where an Environmental Hazard Evaluation substantiates a significant hazard at the site, may additional MIS for remediation purposes be appropriate.

If a significant exposure hazard has been identified in one or more DUs and it is relatively easy and cost effective to remove the contaminated soil, no additional sampling would generally be conducted and the soil just removed to an approved landfill. However, if the contaminated area is large and/or removal very expensive, additional sampling in portions of the contaminated DU(s) may serve to identify large spill areas or specific areas of the site that have generally higher or lower concentrations than other areas. If identified, this information may be helpful for initial removal actions and to help establish DU boundaries for subsequent *Multi-increment* sampling (see specific examples for soil arsenic investigations given in subsection 4.3 below). It is important to note that M*ulti-increment* or discrete sampling to assist remediation decisions is generally more complex than *Multi-increment* sampling for initial site characterization. Consequently, these investigations will be site-specific and should be carefully planned and coordinated with the HEER Office.